

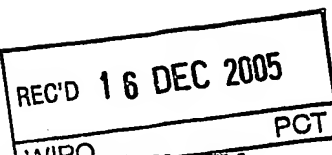
PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)



Applicant's or agent's file reference P27846PC00/ME	FOR FURTHER ACTION		See Form PCT/IPEA/416
International application No. PCT/NL2004/000652	International filing date (day/month/year) 20.09.2004	Priority date (day/month/year) 24.09.2003	
International Patent Classification (IPC) or national classification and IPC G01N21/03, G01N21/35, G01N21/31			
Applicant BERLI B.V.			
1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36. 2. This REPORT consists of a total of 5 sheets, including this cover sheet. 3. This report is also accompanied by ANNEXES, comprising: a. <input checked="" type="checkbox"/> sent to the applicant and to the International Bureau a total of 3 sheets, as follows: <input checked="" type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions). <input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box. b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).			
4. This report contains indications relating to the following items: <input checked="" type="checkbox"/> Box No. I Basis of the opinion <input type="checkbox"/> Box No. II Priority <input type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability <input type="checkbox"/> Box No. IV Lack of unity of invention <input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement <input type="checkbox"/> Box No. VI Certain documents cited <input type="checkbox"/> Box No. VII Certain defects in the international application <input type="checkbox"/> Box No. VIII Certain observations on the international application			
Date of submission of the demand 22.07.2005		Date of completion of this report 07.12.2005	
Name and mailing address of the International preliminary examining authority: European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016		Authorized Officer Verdoordt, E Telephone No. +31 70 340-3577	



**INTERNATIONAL PRELIMINARY REPORT
ON PATENTABILITY**

International application No.
PCT/NL2004/000652

Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
- ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3 and 23.1(b))
 - ☐ publication of the international application (under Rule 12.4)
 - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report):*

Description, Pages

1-9 as originally filed

Claims, Numbers

1-20 as amended (together with any statement) under Art. 19 PCT

Drawings, Sheets

1/4-4/4 as originally filed

☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages
- ☐ the claims, Nos.
- ☐ the drawings, sheets/figs
- ☐ the sequence listing (*specify*):
- ☐ any table(s) related to sequence listing (*specify*):

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- ☐ the description, pages
- ☐ the claims, Nos.
- ☐ the drawings, sheets/figs
- ☐ the sequence listing (*specify*):
- ☐ any table(s) related to sequence listing (*specify*):

* If item 4 applies, some or all of these sheets may be marked "superseded."

**INTERNATIONAL PRELIMINARY REPORT
ON PATENTABILITY**

International application No.
PCT/NL2004/000652

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	1-20
	No: Claims	
Inventive step (IS)	Yes: Claims	1-20
	No: Claims	
Industrial applicability (IA)	Yes: Claims	1-20
	No: Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Re Item V

**Reasoned statement with regard to novelty, inventive step or industrial applicability;
citations and explanations supporting such statement**

Reference is made to the following documents:

D1: US-A-5 734 165 (DUERSELEN LOTHAR E DIPL ING ET AL) 31 March 1998

D2: EP-A-0 457 624 (SIEGER LTD) 21 November 1991

Novelty (Art. 33(2) PCT)

- 1.1 The document D1 is regarded as being the closest prior art to the subject-matter of claim 1, and discloses a gas sensor comprising all features of the preamble of claim 1, i.e. (References in parentheses applying to this document):
at least one light source (7), projection optics (9) and a light reflecting chamber (figure 1), provided with at least one light entry opening (3), which gas sensor further comprises a detector (8) that cooperates with the light reflecting chamber, by means of which detector light from the light source can be detected, wherein the light source can be projected on a light entry opening of the chamber by means of said projection optics.
- 1.2 The subject-matter of independent claim 1 differs from the disclosure of D1 in that the gas sensor comprises at least two light sources, which can each be projected on a light entry opening of the chamber by means of said projection optics.
- 1.3 The subject-matter of claim 1 is therefore considered to be new (Article 33(2) PCT) in the light of D1.

Inventive step (Art. 33(3) PCT)

- 2.1 The technical effect of this difference is to provide a reference light source which produces a reference wavelength at which the gas to be measured has a different light absorption effect. The measurement at this wavelength can then be used to correct the concentration measurement.
- 2.2 The problem to be solved by the present invention may therefore be regarded as how to make a gas sensor insensitive to thermal drift, fouling and ageing. (See also page 2 of the current description, lines 5-13)
- 2.3 This problem as well as this exact solution are well known. Reference is made to

document D2, which discloses the use of two light sources with appropriate filters, wherein one light source is used as reference source, to be able to correct the gas concentration measurement (i.e. col. 2, l. 55 - col. 3, l. 4).

- 2.4 However, the skilled person would not combine document D2 with document D1 for the following reason: In document D1, a different solution is mentioned to obtain a measurement at a reference wavelength (i.e. column 2, lines 35-40), using just one light sources and two detectors. There is thus no hint in D1 to look for another solution, e.g. by using two modulated light sources with different wavelengths, as shown in D2 (i.e. col. 6, l. 56 - col. 7, l. 4).

No other known documents show the idea of using two light sources which are projected on a light entry opening of a light reflecting chamber.

- 2.5 The subject matter of claim 1 of the present application is therefore considered to involve an inventive step (Article 33(3) PCT) in the light of D1 and D2.

Dependent claims 2-20

- 3.1 Claims 2-20 are dependent on claim 1 and as such also meet the requirements of the PCT with respect to novelty and inventive step.

22.07.2005

(82)

CLAIMS

1. Gas sensor (21, 34, 41, 51) comprising at least one light source, projection optics (26, 27; 42; 54) and a light-reflecting chamber (28) provided with at least one light entry opening, which gas sensor further comprises a detector (29) that cooperates with the chamber, by means of which detector light from the light source can be detected, characterized in that the gas sensor comprises at least two light sources (22, 23), which can each be projected on a light entry opening (30, 31; 35) of the chamber (28; 36) by means of said projection optics.
2. Gas sensor according to claim 1, characterized in that the projection optics project each of the light sources on a reduced scale on a light entry opening of the chamber.
3. Gas sensor according to claim 1 or 2, characterized in that the at least two light sources (22, 23) can each be projected on the same light entry opening (35) of the chamber (36) by means of projection optics (26, 27).
4. Gas sensor according to claim 3, characterized in that the light paths between the light sources (22, 23) and the detector (29) are substantially identical.
5. Gas sensor (21, 34, 41, 51) according to any one of the preceding claims, characterized in that the projection optics comprises at least one projection mirror (26, 27; 42; 54).
6. Gas sensor (41; 51) according to claim 5, characterized in that the projection mirror (42; 54) is faceted.
7. Gas sensor (51) according to claim 5 or 6, characterized in that the mirror (54) comprises a number of segments (57, 58, 59, 60), a first group (57, 59) of which segments is used for projecting the first light source (22) on the light entry opening (35) whilst the second group of segments (58, 60) is used for projecting the second light source (23) on the light entry opening (35).

8. Gas sensor according to claim 7, characterized in that the two groups of segments have two different focal points.
- 5 9. Gas sensor according to any one of the preceding claims, characterized in that the light sources (22, 23) are disposed on the same side of the chamber (36).
- 10 10. Gas sensor according to any one of the preceding claims, characterized in that the light sources (22, 23) are spaced apart by a centre distance in the order of the diameter of the light sources.
11. Gas sensor according to any one of the preceding claims, comprising three or more light sources.
- 15 12. Gas sensor according to any one of the preceding claims, characterized in that the chamber (36) is of square cross-section, at least one side of which cross-section has a dimension in the order of the dimension of a light-receiving element of the detector or of the
- 20 dimension of the projection of the light source.
13. Gas sensor according to any one of the preceding claims, characterized in that the cross-sectional area of the chamber (36) gradually decreases from the light entry opening (35) in the direction
- 25 of the detector (29).
14. Gas sensor according to any of the preceding claims, characterized in that the length of the chamber (36) is at least three times greater than the cross-sectional dimension of the chamber.
- 30 15. Gas sensor according to any one of the preceding claims, characterized in that the chamber (36) is channel-shaped, at least one dimension of the chamber being in the order of a dimension of a light-receiving surface (33) of the detector (29).
- 35 16. Gas sensor according to any one of the preceding claims,

characterized in that the chamber (28; 36) is provided with a light exit opening (32; 37), near which light exit opening the detector (29) is mounted.

5 17. Gas sensor according to any of the preceding claims, characterized in that a wavelength-determining element (24, 25) is disposed between at least one light source (22, 23) and the detector (29).

10 18. Gas sensor according to claim 17, characterized in that the wavelength-determining element (24, 25) is a filter.

19. Gas sensor according to claim 17 or 18, characterized in that the wavelength-determining element (24, 25) is disposed between the light source and the projection optics.

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20. Gas sensor according to claim 17 or 18, characterized in that the wavelength-determining element is disposed between the projection optics and the detector.